

ABSTRACT OF THE DISCLOSURE

Nanocomposite materials having a composition including an inorganic constituent, a preformed organic polymer constituent, and a metal ion sequestration constituent are disclosed. The nanocomposites are characterized by being single phase, substantially homogeneous materials wherein the preformed polymer constituent and the inorganic constituent form an interpenetrating network with each other. The inorganic constituent may be an inorganic oxide, such as silicon dioxide, formed by the *in situ* catalyzed condensation of an inorganic precursor in the presence of the solvated polymer and metal ion sequestration constituent. The polymer constituent may be any hydrophilic polymer capable of forming a type I nanocomposite such as, polyacrylonitrile (PAN), polyethyleneoxide (PEO), polyethylene glycol (PEG), polyvinyl acetate (PVAc), polyvinyl alcohol (PVA), and combinations thereof. Nanocomposite materials of the present invention may be used as permeable reactive barriers (PRBs) to remediate contaminated groundwater. Methods for making nanocomposite materials, PRB systems, and methods of treating groundwater are also disclosed.

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